What is claimed is:

1. A pallet for supporting and protecting a substrate during processing in a system for processing of substrates, comprising:

a pallet top; and

a pallet bottom;

wherein said substrate is clamped between said pallet top and said pallet bottom.

2. A pallet as recited in claim **1**, wherein said pallet top includes a plurality of contactors for making electrical contact with a plurality of test pads on a surface of said substrate; wherein there is a predetermined one-to-one mapping between said contactors and said test pads.

3. A pallet as recited in claim **2** further comprising:

internal drive electronics for controlling a plurality of signals directed to said plurality of contactors, wherein there is a predetermined one-to-one mapping between said signals and said contactors;

an internal power distribution system to supply power to said internal drive electronics; and

means for storing energy for said internal power distribution system.

4. A pallet as recited in claim **3** further comprising:

a data receiver connected to said internal drive electronics, for receiving signals sent to said pallet from a system control for processing of said substrate; and

a data transmitter connected to said internal drive electronics, for sending signals from said pallet to said system control for processing of said substrate.

5. A pallet as recited in claim **2** wherein said pallet bottom includes means for preventing relative motion between said substrate and said pallet bottom whenever said pallet is assembled, and said pallet top further includes:

means for detecting locations of at least two alignment marks on a surface of said substrate;

means for determining a required displacement vector for said pallet top with respect to said substrate, said required displacement vector being defined as a displacement of said pallet top with respect to said substrate which would approximately center said contactors with respect to said test pads, consistent with said predetermined one-to-one mapping between said contactors and said test pads; and

means for aligning said pallet top with respect to said substrate, according to said required displacement vector.

6. Apparatus for processing a substrate, comprising:

a process chamber;

a pallet for supporting and protecting said substrate during processing in said process chamber, said pallet including:

a pallet top;

a pallet bottom;

means for clamping said substrate between said pallet top and said pallet bottom; and

wherein said process chamber includes a port configured to accommodate passage of said pallet into and out of said process chamber.

7. Apparatus as recited in claim **6** wherein said process chamber further includes a charged particle optical assembly, said charged particle optical assembly having a plurality of charged particle optical columns, wherein each of said charged particle optical columns includes:

a charged particle source for generating a charged particle beam;

a plurality of lenses for focusing said charged particle beam onto a surface of said substrate; and

a beam deflector for deflecting said charged particle beam on the surface of said substrate.

8. Apparatus as recited in claim **6**, wherein said pallet top includes a plurality of contactors for making electrical contact with a plurality of test pads on a surface of

said substrate; wherein there is a predetermined one-to-one mapping between said contactors and said test pads.

9. Apparatus as recited in claim **8** wherein said pallet further includes:

internal drive electronics for controlling a plurality of signals directed to said plurality of contactors, wherein there is a predetermined one-to-one mapping between said signals and said contactors;

an internal power distribution system to supply power to said internal drive electronics; and

means for storing energy for said internal power distribution system.

10. Apparatus as recited in claim **9** wherein said pallet further includes:

a first data receiver connected to said internal drive electronics; and

a first data transmitter connected to said internal drive electronics;

wherein said process chamber further includes:

a second data transmitter for transmitting data to said first data receiver in said pallet; and

a second data receiver for receiving data from said first data transmitter in said pallet.

11. Apparatus as recited in claim **8** wherein said pallet bottom includes means for preventing relative motion between said substrate and said pallet bottom whenever said pallet is assembled, and said pallet top further includes:

means for detecting locations of at least two alignment marks on a surface of said substrate;

means for determining a required displacement vector for said pallet top with respect to said substrate, said required displacement vector being defined as a displacement of said pallet top with respect to said substrate for substantially centering said contactors with respect to said test pads, consistent with said predetermined one-to-one mapping between said contactors and said test pads; and

means for aligning said pallet top with respect to said substrate, according to said required displacement vector.

12. Apparatus as recited in claim **7** wherein said process chamber further includes a plurality of bi-directional motor-driven rollers configured to support and to assist in moving said pallet under said charged particle optical assembly for charged particle beam testing of said substrate in said pallet.

13. Apparatus as recited in claim **6** wherein said process chamber further includes:

at least one pallet X-axis position sensor, said X-axis being parallel to said motion of said pallet under said charged particle optical assembly;

at least one pallet Y-axis position sensor, said Y-axis being perpendicular to said motion of said pallet under said charged particle optical assembly; and

at least one pallet Yaw sensor, said Yaw being defined as the rotation angle about an axis perpendicular to the plane of said substrate in said pallet.

14. A system for processing of substrates, comprising:

a system control;

a multiplicity of pallets, each of said pallets for carrying a substrate;

a process chamber including a first port configured to accommodate passage of one of said pallets;

a loadlock assembly including a plurality of loadlocks, said loadlock assembly being coupled to said process chamber for passage of a pallet through said first port into and out of said process chamber, said loadlock assembly being configured to accommodate a first plurality of pallets of said multiplicity of pallets; and

a pallet elevator including a second port configured to accommodate passage of one or more of said pallets into and out of said pallet elevator, said pallet elevator being configured to accommodate a second plurality of pallets of said multiplicity of pallets;

wherein said loadlock assembly is configured to move relative to said process chamber to allow positioning of any one pallet of said first plurality of pallets for passage through said first port into and out of said process chamber; and

said pallet elevator is configured to move relative to said loadlock assembly to allow positioning of any one pallet of said second plurality of pallets for passage through said second port in said pallet elevator.

15. A system as recited in claim **14** wherein each of said pallets includes:

a pallet top;

a pallet bottom; and

means for clamping said substrate between said pallet top and said pallet bottom.

16. A system as recited in claim **14** wherein said process chamber further includes a charged particle optical assembly, said charged particle optical assembly having a plurality of charged particle optical columns, wherein each of said charged particle optical columns includes:

a charged particle source for generating a charged particle beam;

a plurality of lenses for focusing said charged particle beam onto a surface of said substrate; and

a beam deflector for deflecting said charged particle beam on the surface of said substrate; and

said system for processing of substrates further comprises an optics control, electrically connected to said charged particle optical assembly and said system control.

17. A system as recited in claim **16** wherein said process chamber further includes a plurality of bi-directional motor-driven rollers configured to support and to assist in moving one pallet of said first plurality of pallets under said charged particle optical assembly for charged particle beam testing of said substrate in said pallet.

18. A system as recited in claim **14** wherein each of said loadlocks includes one or more sets of bi-directional motor-driven rollers, each of said sets of bi-directional motor-driven rollers being configured to support one of said pallets of said first plurality of pallets in said loadlock, and to assist in moving one of said pallets of said first plurality of pallets into and out of said loadlock through said first port in said process chamber and through said second port in said pallet elevator.

19. A system as recited in claim **14** wherein said pallet elevator includes one or more sets of bi-directional motor-driven rollers, each of said sets of bi-directional

motor-driven rollers being configured to support one of said pallets of said second plurality of pallets in said pallet elevator, and to assist in moving one of said pallets of said second plurality of pallets into and out of said pallet elevator through said second port in said pallet elevator.

20. A system as recited in claim **15** wherein said pallet elevator further includes:

a plurality of pin plates, wherein each pin plate of said plurality of pin plates is positioned beneath a corresponding one of a plurality of sets of bi-directional motor-driven rollers; and

a pin plate actuator configured to move said plurality of pin plates along a vertical motion axis.

21. A system as recited in claim **20** wherein each pin plate of said plurality of pin plates includes:

a plurality of long pins; and

a plurality of short pins;

wherein said vertical motion axis is configured to enable each of said plurality of long pins and each of said plurality of short pins to pass through one of a plurality of holes in said pallet bottom, said motion of said pin plate thereby enabling said plurality of long pins to lift said pallet top off of said substrate and to lift said pallet top off of said pallet bottom; and enabling said plurality of short pins to lift said substrate off said pallet bottom.

22. A system as recited in claim **15** wherein said pallet top includes a plurality of contactors, each contactor for making electrical contact with one of a plurality of test pads on a surface of said substrate, wherein there is a predetermined one-to-one mapping between said contactors and said test pads.

23. A system as recited in claim **22** wherein each pallet of said plurality of pallets further includes:

internal drive electronics for controlling a plurality of signals directed to said plurality of contactors, wherein there is a predetermined one-to-one mapping between said signals and said contactors;

an internal power distribution system to supply power to said internal drive electronics; and

means for storing energy for said internal power distribution system.

24. A system as recited in claim **23** wherein each pallet of said plurality of pallets further includes:

a first data receiver connected to said internal drive electronics; and

a first data transmitter connected to said internal drive electronics; and

said process chamber further includes:

a second data transmitter for transmitting data to said first data receiver in said pallet, said second data transmitter being electrically connected to said system control; and

a second data receiver for receiving data from said first data transmitter in said pallet, said second data receiver being electrically connected to said system control.

25. A system as recited in claim **22** wherein said pallet bottom includes means for preventing relative motion between said substrate and said pallet bottom whenever said pallet is assembled; and said pallet top further includes:

means for detecting locations of at least two alignment marks on a surface of said substrate;

means for determining a required displacement vector for said pallet top with respect to said substrate, said required displacement vector being defined as a displacement of said pallet top with respect to said substrate that would approximately center said contactors with respect to said test pads, consistent with said predetermined one-to-one mapping between said contactors and said test pads; and

means for precisely displacing said pallet top with respect to said pallet bottom, according to said required displacement vector.

26. A system as recited in claim **24** wherein said system for processing of substrates further comprises an X-Y-Yaw readout, electrically connected to said system control; and said process chamber further includes:

at least one pallet X-axis position sensor, said X-axis being parallel to said motion of said pallets under said charged particle optical assembly, said at least one X-axis position sensor being electrically connected to said X-Y-Yaw readout to transmit X-axis position data;

at least one pallet Y-axis position sensor, said Y-axis being perpendicular to said motion of said pallets under said charged particle optical assembly, said at least one Y-axis position sensor being electrically connected to said X-Y-Yaw readout to transmit Y-axis position data; and

at least one pallet Yaw sensor, said Yaw being defined as a rotation angle about an axis perpendicular to the plane of said substrate in said pallet, said at least one Yaw sensor being electrically connected to said X-Y-Yaw readout to transmit Yaw data.

27. A system as recited in claim **26** wherein said system control sends said pallet X-axis position data, said pallet Y-axis position data, and said pallet Yaw data to said optics control for controlling said beam deflector, and to said second data transmitter for transmission to said first receiver on said pallet, for use by said internal drive electronics for controlling said plurality of signals directed to said plurality of contactors.

28. A system for processing of substrates, comprising:

a system control;

a multiplicity of pallets, each of said pallets for holding a substrate;

a process chamber including a port configured to accommodate passage of one of said pallets; and

a loadlock assembly including a plurality of loadlocks, said loadlock assembly being coupled to said process chamber, said loadlock assembly being configured to accommodate a plurality of said multiplicity of pallets;

wherein said loadlock assembly is configured to move relative to said process chamber to allow positioning of a selected one of said plurality of said pallets for passage through said port in said process chamber.

29. A system as recited in claim **28** wherein each of said pallets includes:

a pallet top;

a pallet bottom; and

means for clamping said substrate between said pallet top and said pallet bottom.

30. A system as recited in claim **28** wherein said process chamber further comprises a charged particle optical assembly, said charged particle optical assembly having a plurality of charged particle optical columns, wherein each of said charged particle optical columns includes:

a charged particle source for generating a charged particle beam;

a plurality of lenses for focusing said charged particle beam onto a surface of said substrate; and

a beam deflector for deflecting said charged particle beam on a surface of said substrate; and

said system for processing of substrates further comprises an optics control, electrically connected to said charged particle optical assembly and said system control.

31. A system as recited in claim **30** wherein said process chamber further includes a plurality of bi-directional motor-driven rollers configured to support and to assist in moving a pallet of said plurality of pallets under said charged particle optical assembly for charged particle beam testing of said substrate in said pallet.

32. A system as recited in claim **28** wherein each of said loadlocks further includes one or more sets of bi-directional motor-driven rollers, each of said sets of bi-directional motor-driven rollers being configured to support one of said pallets of said plurality of pallets in said loadlock, and to assist in moving one of said pallets of said plurality of pallets into and out of said loadlock through said port in said process chamber.

33. A system as recited in claim **29** wherein each of said loadlocks further includes:

a plurality of pin plates, wherein each pin plate of said plurality of pin plates is positioned beneath a corresponding one of a plurality of sets of bi-directional motor-driven rollers; and

a pin plate actuator configured to move said plurality of pin plates along a vertical motion axis.

34. A system as recited in claim **33** wherein each pin plate of said plurality of pin plates includes:

a plurality of long pins; and

a plurality of short pins;

wherein said vertical motion axis is configured to enable each of said plurality of long pins and each of said plurality of short pins to pass through a corresponding one of a plurality of holes in said pallet bottom, said motion of said pin plate thereby enabling said plurality of long pins to lift said pallet top off of said substrate and to lift said pallet top off of said pallet bottom, and enabling said plurality of short pins to lift said substrate off said pallet bottom.

35. A system as recited in claim **29** wherein said pallet top includes a plurality of contactors, each contactor for making electrical contact with one of a plurality of test pads on a surface of said substrate, wherein there is a predetermined one-to-one mapping between said contactors and said test pads.

36. A system as recited in claim **35** wherein each pallet of said multiplicity of pallets further includes:

internal drive electronics for controlling a plurality of signals directed to said plurality of contactors, wherein there is a predetermined one-to-one mapping between said signals and said contactors;

an internal power distribution system to supply power to said internal drive electronics; and

means for storing energy for said internal power distribution system.

37. A system as recited in claim **36** wherein each of said pallets of said multiplicity of pallets further includes:

a first data receiver connected to said internal drive electronics; and

a first data transmitter connected to said internal drive electronics; and

said process chamber further includes:

a second data transmitter for transmitting data to said first data receiver in said pallet, said second data transmitter being electrically connected to said system control; and

a second data receiver for receiving data from said first data transmitter in said pallet, said second data receiver being electrically connected to said system control.

38. A system as recited in claim **35** wherein said pallet bottom includes means for preventing relative motion between said substrate and said pallet bottom whenever said pallet is assembled; and said pallet top further includes:

means for detecting locations of at least two alignment marks on a surface of said substrate;

means for determining a required displacement vector for said pallet top with respect to said substrate, said required displacement vector being defined as a displacement of said pallet top with respect to said substrate that would approximately center said contactors with respect to said test pads, consistent with said predetermined one-to-one mapping between said contactors and said test pads; and

means for aligning said pallet top with respect to said substrate, according to said required displacement vector.

39. A system as recited in claim **37** wherein said system for processing of substrates further comprises an X-Y-Yaw readout, electrically connected to said system control, and said process chamber further includes:

at least one pallet X-axis position sensor, said X-axis being parallel to said motion of said pallets under said charged particle optical assembly, said at least one X-axis position sensor being electrically connected to said X-Y-Yaw readout to transmit X-axis position data;

at least one pallet Y-axis position sensor, said Y-axis being perpendicular to said motion of said pallets under said charged particle optical assembly, said at least

one Y-axis position sensor being electrically connected to said X-Y-Yaw readout to transmit Y-axis position data; and

at least one pallet Yaw sensor, said Yaw being defined as a rotation angle about an axis perpendicular to the plane of said substrate in said pallet, said at least one Yaw sensor being electrically connected to said X-Y-Yaw Readout to transmit Yaw data.

40. A system as recited in claim **39** wherein said system control sends said pallet X-axis position data, said pallet Y-axis position data, and said pallet Yaw data to said optics control for controlling said beam deflector, and to said second data transmitter for transmission to said first receiver on said pallet, for use by said internal drive electronics to control said plurality of signals directed to said plurality of contactors.

41. A method for processing substrates that protects and supports said substrates from damage during processing, comprising the steps of:

a) inserting said substrate between a pallet top and a pallet bottom, said pallet top and said pallet bottom being separated a sufficient distance to permit said insertion of said substrate;

b) moving said pallet top, said substrate, and said pallet bottom, together and locking said pallet top to said pallet bottom, thereby clamping said substrate between;

c) inserting said pallet into a process chamber;

d) processing said substrate clamped in said pallet in said process chamber;

e) after said processing is complete, removing said pallet from said process chamber;

f) unlocking said pallet top from said pallet bottom;

g) separating said pallet top, said substrate, and said pallet bottom, said pallet top and said pallet bottom being separated a sufficient distance to permit removal of said substrate;

h) removing said substrate from between said pallet top and said pallet bottom;

returning to step a), above and repeating said process for each said substrate to be processed.

42. The method of claim **41** wherein said substrate is a flat panel display substrate comprising a plurality of pixels.

43. The method of claim **42** wherein said processing is electron-beam testing of said pixels on said flat panel display substrate.